**“I want to tell people what I’ve seen so that maybe something will happen”**

It’s five to midnight for the world’s coral reefs. If global warming continues at its current pace, they will be gone by the end of the century. Marine biologist Marc Kochzius’ decades-long investigations into their movement patterns may give corals a fighting chance in the battle against global warming. “We can’t afford to be fatalistic. To do so would mean game over.”

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Photo: Marc Kochzius

*Summary*

*Marine biologist Marc Kochzius’ has investigated the movement patterns and connectivity of corals in the Western Indian Ocean since 2011. His findings help conservationists and lawmakers decide where to place marine-protected areas so that they're more effective in restoring coral reefs’ biodiversity. He’s also made it his mission to educate the public about the importance of coral reefs and the threats they face because of climate change.*

As one of the most diverse ecosystems in the world, coral reefs are vital to the ocean’s biodiversity. They take up less than 1% of the ocean floor but are home to more than 25% of marine life. Five-hundred million people [rely](https://www.sciencedaily.com/releases/2019/07/190701144527.htm) on them for their food and livelihoods, and together they represent an economic value of 9.9 billion euros per year.

But many of the world’s coral reefs are in terrible shape due to pollution, overfishing and destructive fishing methods. The greatest threat to their existence, however, comes from climate change. Scientists [predict](https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/) that coral reefs will be gone by the end of the century if global warming continues at its current pace.

Marine-protected areas have emerged as a promising conservation method that might be able to help coral reefs survive climate change. No or very little human activity is allowed in these marine-protected areas so as to allow a coral reef to recover, its biodiversity to return to what it was, and fish populations to replenish.

The decision as to where to place these areas is today mainly determined by two factors: biodiversity and community support, says Marc Kochzius, a professor in marine biology. “Is the reef healthy and teeming with a large abundance of different species, and second, will the local population support this marine-protected area?” he explains. “But [conservationists] don’t really look at: is this marine-protected area in contact with other marine-protected areas?”

That’s important because unlike for instance whales or sharks, corals can’t just up and leave to a new habitat where they are less vulnerable. Instead, corals travel through their offspring – their eggs and larvae drift to other locations with the ocean currents, sometimes a handful, sometimes thousands of kilometres. This type of delayed, generational travel is the only way corals have of returning to a habitat or repopulating themselves.

This means that to improve their effectiveness, it’s important that marine-protected areas are placed so that eggs and larvae can travel from one area to the next. “Say, you protect a particular, very beautiful reef but its larvae drift to other locations and don’t come back, […] and no larvae travel to this reef from other marine-protected areas,” he explains. “In this case, it wouldn’t be useful to protect just this area because in the long term its animal population will diminish because the animals will grow older and die.”

But how can policymakers and conservationists know in advance in which direction coral eggs and larvae will drift?

This is precisely the question that Kochzius has investigated for over two decades. To map the movements of coral reef species, Kochzius and his research team use population genetic methods on samples of corals and other species. By comparing the genetic similarities of different populations of a particular species, they try to unravel the travel patterns of corals. If, for instance, samples of the same species taken in two adjacent areas are genetically completely different, an oceanographic barrier is likely acting as a roadblock, preventing coral larvae and eggs from travelling any further.

Since 2011, Kochzius has focused his research on the Western Indian Ocean, situated off the coast of East African countries like Mozambique and the island of Madagascar. In doing so, he has filled a blank spot on the global world map of coral movement patterns. “We are the research group that has done the most research on the connectivity of coral reefs and mangroves in East Africa worldwide. As a result, we today have a much better understanding of the connectivity of this region, which in turn can produce nature conservancy recommendations for these countries,” he says, pointing out that local communities in these places heavily rely on coral reefs for food and income.

The tentative results of the samples he has been collecting in Kenia, Tanzania, Mozambique and Madagascar since 2011 appear to indicate the existence of potential barriers in the Mozambique Channel. By examining the genetic similarities between corals, fishes, sea stars, snails and shrimps – species that all produce offspring that drift to other locations with the currents – Kochzius and his team found that populations north of Madagascar were different from those to the south of the island, indicating the existence of a barrier keeping the species from drifting back and forth between both areas. They also found evidence pointing to eddies, or mini-underwater whirlpools in the Mozambique channel, which form a barrier for dispersal. When eggs and larvae end up in such an eddy, they become trapped and eventually die.

**Bonn, Bremen, Brussels**

Growing up in the Rhineland area of Western Germany, Kochzius knew he wanted to study biology. After completing his undergraduate studies in Bonn, he applied to the graduate programmes of a handful universities and eventually settled on Bremen, where he completed the then-equivalent of a master’s programme. He originally planned on specialising in the Antarctic but when an opportunity opened up to study coral reefs in the Philippines as part of his graduate program, he took it with both hands. “And I kind of have remained stuck in the tropics since then.”

After completing his PhD at the Leibniz Center for Tropical Marine Research

in 2002, he stayed on for another eight years at the research group for Biotechnology and Molecular Genetics at Bremen University until he moved to Brussels to become a professor in marine biology.

When he was younger, Kochzius would spend multiple months diving in the tropics to collect samples, but ever since he’s become a father of two he’s capped his missions abroad at a maximum duration of three weeks, usually doing zero to two missions per year.

And though mention of Madagascar and Tanzania may bring to mind scenic beaches, inviting blue waters and generally a good time, these diving expeditions are no holiday. Rather, Kochzius says, they are exercises in endurance that require much prior planning, jumping through administrative hoops, and advanced creative thinking skills. “If what you had planned isn’t going to work … – you can’t just go on sitting there waiting in an airport, a hotel and waiting for a flight,” he says. “You have to change, adjust your plans really quickly.”

Not too long ago, Kochzius for instance travelled to Antananarivo, the capital of Madagascar, from where he would go on to the southern part of the island to collect samples around the coast. Having taken a night flight from Paris, Kochzius arrived in Antananarivo to find his local flight cancelled because airport personnel had gone on strike. His only other travel option was to take a bus to the southern part of the island, but because night travel is so dangerous in the southern part of the island, buses only travel in convoy. And he would never make it in time to catch one of the convoys.

After brainstorming with the local PhD student from Madagascar with whom he’d be collecting scientific samples, they decided on a bold, multi-leg journey – they would first take a night bus to the northern, safer part of the country, subsequently transfer to a smaller bus, to finally take a ferry to the island where they needed to be. The plan worked: after 24 hours of travel, Kochzius arrived at his final destination in the late morning. Two hours later, he began diving.

Kochzius is also quick to dispel any idea that he’s sipping pina coladas from a desk chair when not diving. “You’re either diving or travelling during these trips. You only time have time to relax if you have dived and if the next leg of your journey is a flight. In which case you can’t fly for 24 hours because” of health reasons, he explains. “But that time is usually spent labelling all the samples we took, or taking more samples in the mangroves.”

**Scientists in action**

Having seen corals undergo dramatic changes – sometimes in the space of just a couple of years – Kochzius started feeling a growing sense of urgency in recent years. “I want to tell people what I’ve seen so that maybe something will happen. I want to alert them to the problems and tell them about the terrible shape [coral reefs] are in in some countries,” he says. “Because most people simply aren’t aware or don’t realise how grave the situation is.”

First in English, later in Dutch, he began giving performances as part of the comedy-cum-lecture event series Bright Comedy Club. His main tasks might be research and education, but Kochzius sees this popularising work as an equally important part of scientists’ job. Because, he says, lawmakers will only take action when there’s public pressure to do so, and that’s where scientists like him come in.

Pointing to the climate protests organised by youths in Sweden, Germany and Belgium, Kochzius says that scientists can’t afford to remain on the side lines. “When there is a public groundswell like this I think it’s important that as scientists we support it with our knowledge and expertise,” and confirm that climate change poses a great threat, he says. “But I think it’s equally important to give lectures, to put yourself forward so as to reach people and make them aware so they better understand what’s really going on.”

And even though the road ahead is long, and the predictions for corals are only getting bleaker, this makes Kochzius resolved more so than discouraged. “We can’t afford to be fatalists. To do so would mean game over.”